CLAIMS

Having described the preferred embodiments, the invention is now claimed to be:

1. A magnetic resonance imaging scanner comprising:

a magnet **(20)** generating a temporally constant magnetic field;

one or more magnetic field gradient-generating structures **(30)** superimposing selected magnetic field gradients on the temporally constant magnetic field;

a radio frequency shield **(64)**;

a radio frequency coil **(32)** disposed inside of the radio frequency shield **(64)** and selectively producing a radio frequency field; and

a magnetic field-modifying structure **(60)** designed to enhance the temporally constant magnetic field, the magnetic field-modifying structure being disposed inside of the radio frequency shield **(64)** and including particles of magnetic material **(70_1, 70_2, 70_3, 70_4)** generally smaller in at least one dimension than a skin depth of the radio frequency field in the magnetic material dispersed in an insulating binder **(72)**.

2. The magnetic resonance imaging scanner as set forth in claim **1**, wherein the particles of magnetic material **(70_1, 70_2, 70_3, 70_4)** dispersed in the binder **(72)** have a fill factor of at least about 50% by volume.

3. The magnetic resonance imaging scanner as set forth in claim **1**, wherein the particles of magnetic material **(70_1, 70_2, 70_3, 70_4)** are generally smaller in at least one dimension than about one-tenth of the skin depth of the radio frequency field in the magnetic material.

4. The magnetic resonance imaging scanner as set forth in claim **1**, wherein the particles of magnetic material **(70_1, 70_2, 70_3, 70_4)** are generally smaller than about 10 microns in at least one dimension.

5. The magnetic resonance imaging scanner as set forth in claim **1**, wherein the particles of magnetic material **(70_1, 70_2, 70_3, 70_4)** are generally smaller than about 4 microns in at least one dimension.

6. The magnetic resonance imaging scanner as set forth in claim **1**, wherein the particles of magnetic material **(70_1, 70_4)** generally do not have a direction of elongation.

7. The magnetic resonance imaging scanner as set forth in claim **1**, wherein the particles of magnetic material **(70_2)** are generally wire-shaped.

8. The magnetic resonance imaging scanner as set forth in claim **7**, wherein the generally wire-shaped particles **(70_2)** are oriented with long directions generally transverse to the temporally constant magnetic field and generally parallel to a tangential direction.

9. The magnetic resonance imaging scanner as set forth in claim **1**, wherein the particles of magnetic material **(70_3)** are generally planar.

10. The magnetic resonance imaging scanner as set forth in claim **9**, wherein the generally planar particles **(70_3)** are oriented with plane normals generally parallel to the temporally constant magnetic field.

11. The magnetic resonance imaging scanner as set forth in claim **1**, wherein the radio frequency coil **(32)** includes a plurality of parallel rungs, and the particles of magnetic material **(70_1, 70_2, 70_3, 70_4)** are disposed at least partially between the rungs.

12. The magnetic resonance imaging scanner as set forth in claim **1**, wherein the magnetic field-modifying structure **(60)** includes:

a plurality of generally annular structures **(62)** containing particles of magnetic material **(70_1, 70_2, 70_3, 70_4)**, the generally annular structures **(62)** being oriented generally transverse to the temporally constant magnetic field, the annular structures **(62)** having annular cross-sections elongated transverse to the temporally constant magnetic field.

13. The magnetic resonance imaging scanner as set forth in claim **1**, wherein the magnetic field-modifying structure **(60)** includes:

a plurality of magnetic generally annular structures **(62)** containing the particles of magnetic material **(70_1, 70_2, 70_3, 70_4)** in the insulating binder **(72)**, the magnetic generally annular structures **(62)** being oriented generally transverse to the temporally constant

magnetic field, the magnetic annular structures **(62)** having a longitudinal demagnetization factor **(*N_z*)** parallel to the temporally constant magnetic field and a tangential demagnetization factor **(*N_T*)** in a tangential direction transverse to the temporally constant magnetic field, the longitudinal demagnetization factor being larger than the tangential demagnetization factor to produce tangential flux guiding.

14. The magnetic resonance imaging scanner as set forth in claim **1**, wherein the magnetic field-modifying structure **(60)** has a longitudinal demagnetization factor **(*N_z*)** parallel to the temporally constant magnetic field and a tangential demagnetization factor **(*N_T*)** in a tangential direction transverse to the temporally constant magnetic field, the longitudinal demagnetization factor being larger than the tangential demagnetization factor to produce tangential flux guiding.

15. A magnetic resonance imaging scanner comprising:

a magnet **(20)** generating a temporally constant magnetic field;

one or more magnetic field gradient-generating structures **(30)** superimposing selected magnetic field gradients on the temporally constant magnetic field;

a radio frequency coil **(32)** selectively producing a radio frequency field; and

a magnetic field-modifying structure **(60)** designed to enhance the temporally constant magnetic field, the magnetic field-modifying structure having a longitudinal demagnetization factor **(*N_z*)** parallel to the temporally constant magnetic field and a tangential demagnetization factor **(*N_T*)** in a tangential direction transverse to the temporally constant magnetic field, the longitudinal demagnetization factor being larger than the tangential demagnetization factor to produce tangential flux guiding.

16. The magnetic resonance imaging scanner as set forth in claim **15**, wherein the magnetic field-modifying structure **(60)** includes:

a plurality of generally annular structures **(62)** oriented generally transverse to the temporally constant magnetic field, the annular structures having annular cross-sections elongated transverse to the temporally constant magnetic field.

17. The magnetic resonance imaging scanner as set forth in claim **15**, wherein the magnetic field-modifying structure **(60)** includes:

ferromagnetic particles **(70_1, 70_2, 70_3, 70_4)** that are generally smaller than a skin depth of the radio frequency field in the magnetic material in at least one dimension; and

an insulating binder **(72)** in which the ferromagnetic particles are dispersed.

18. The magnetic resonance imaging scanner as set forth in claim **17**, wherein the ferromagnetic particles **(70_1, 70_2, 70_3, 70_4)** are dispersed in the binder **(72)** with a fill factor greater than about 50% by volume.

19. The magnetic resonance imaging scanner as set forth in claim **17**, wherein the ferromagnetic particles **(70_2, 70_3)** have an anisotropic particle demagnetization factor with a largest particle demagnetization factor component generally oriented in the direction of the temporally constant magnetic field and a smaller particle demagnetization factor component oriented in a tangential direction transverse to the direction of the temporally constant magnetic field.